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Automatic Surveillance using Motion Detection

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Abstract— The current video surveillance techniques store the complete video even if there are many idle frames in the video. To go through the complete video is a cumbersome task. The storage requirement of such videos is also huge. So we are attempting to design an application which ignores the idle frames from the video, with effective and real time object detection and video surveillance system with the help of SOBEL operator algorithm, for edge detection, in order to reduce the amount of storage space and remove the redundancy from the video. The aforementioned system can be implemented using a webcam or a CCTV and an efficient algorithm to detect the motion and robustly distinguishes the changes in consecutive frames and ignores the lighting changes. Once the motion is detected, the application will send SOS and activate the alert system and start storing the video. Storing of the video will automatically come to halt when there is a stagnancy in the scene.

Keywords— Intelligent Video Surveillance, Real-time Motion Detection, Automatic Surveillance, optimum storage surveillance, Sensor less surveillance, Motion Detection in Spatial domain, Alarm trigger on motion detection.

I. INTRODUCTION

Traditional video surveillance takes a huge amount of storage space. Recording everything captured by a surveillance camera consumes the large storage space and hence limits the duration of video that can be stored. In addition, recording everything makes it time-consuming for a human to review the stored video. All these disadvantages limit the effectiveness of traditional video surveillance. To solve these problems, recording only crucial images that contains important information is the only way. This project uses a robust motion detection algorithm for real-time motion detection by considering and information, i.e., image that contains motion in the scene. This can be done with a web camera and a motion detection algorithm that detects motion. The motion detection algorithm robustly distinguishes motion from lighting changes. Web camera can take the snapshot of the moving object and at the same time, it will activate the warning system before storing the frames on the memory.

Identifying moving objects from a video sequence is a fundamental and critical task in many computer vision applications. We will be using SOBEL filter which comes under edge detection algorithms, and creates an image which emphasizes edges and transitions. The SOBEL operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations.

II. ACKNOWLEDGED RELEVENT WORK

We studied various techniques that are related to motion detection, especially those that detect the moving object in a stagnant scene. Parameters such as shadow, lighting change over time and the slow processor, negatively affects the degree of accuracy of an algorithm.

Many pundits have worked to raise the degree of accuracy of algorithms under indoor scenes and tried to provide solutions to the aforementioned problems.

"*Implementation of motion detection system*" [2] put forward a motion detection system which provides an efficient method for surveillance purposes and provide a facility to use an audio file as alarm signal. "***Tracking And Recognizing The Moving Object In Real Time Using Frame Difference Method***" [3] states motion detection and object tracking method which is simple and direct with which the changing part in video can be quickly detected. "***Improved Background***

Matching Framework For Motion Detection" [4] proposed a temporal differencing to detect the moving object and give the alarming in time and produces high accuracy. This method is fast and achieves better detection performance.

Motion Detection and Object Tracking mentioned in "***Motion and Feature based Person Tracking in Surveillance Videos***" [5] is a popular technique which is robust against the complex, deformed and changeable shape. This method is scale and rotation invariant, as well as faster in terms of processing time.

"Detecting Moving People in Video Streams" [6] proposed a motion segmentation method to detect with high accuracy the motion inside the monitored scene. In "High Definition Surveillance System Using Motion Detection Method Based on FPGA DE-II 70 Board" [7], motion detection approach will reduce the unwanted recording of surveillance videos. This method consumes low power. . In "LOBS: Local Background Subtracter for Video Surveillance" [8] background subtraction technique are used to detect the moving object and then remove the shadow in subsequent phase.

III. OVERVIEW

The proposed model will work in following steps:

- Continuous capturing of the video using a CCTV/webcam and division of the video into an array of frames.
- Converting the current frame into GREYSCALE format for easier and quick detection of edges.
- Comparing the extracted information from the current GREYSCALED image to the image captured before it (residing in buffer).
- If there both the images are identical i.e. there is no motion in the scene, then discard the image in the buffer and store the current GREYSCALED image in the buffer and use it as a reference to next image.
- Else i.e. the images are not identical, start storing the video and trigger the alarm.
- In the meantime, SMS/E-mail will be sent to the owner of the place or to whomsoever in charge.
- As soon as there is stagnancy in the scene i.e. no motion is detected, the system will stop storing the video in the HDD.

The architecture of the proposed system is shown in fig.1 whereas the flow of the system is illustrated in fig.2. The various algorithms used in the system are also described in the following section.

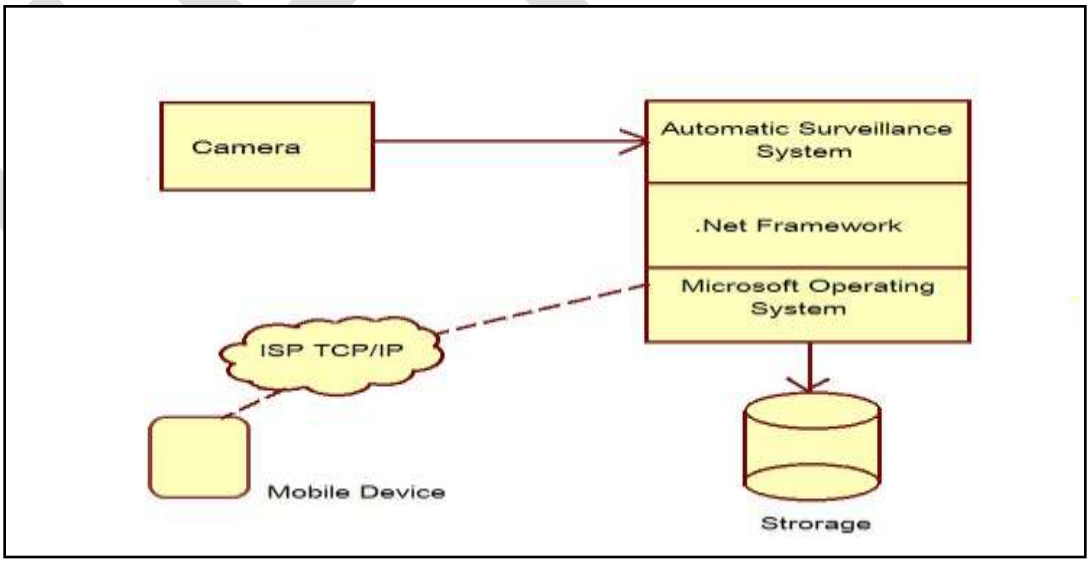

Fig.1 Architecture of the proposed system

Since the framework is restricted to Microsoft's OS, our system will only work Microsoft OS. If the system is connected to Internet then auto-generated E-mail will be sent to respective person.

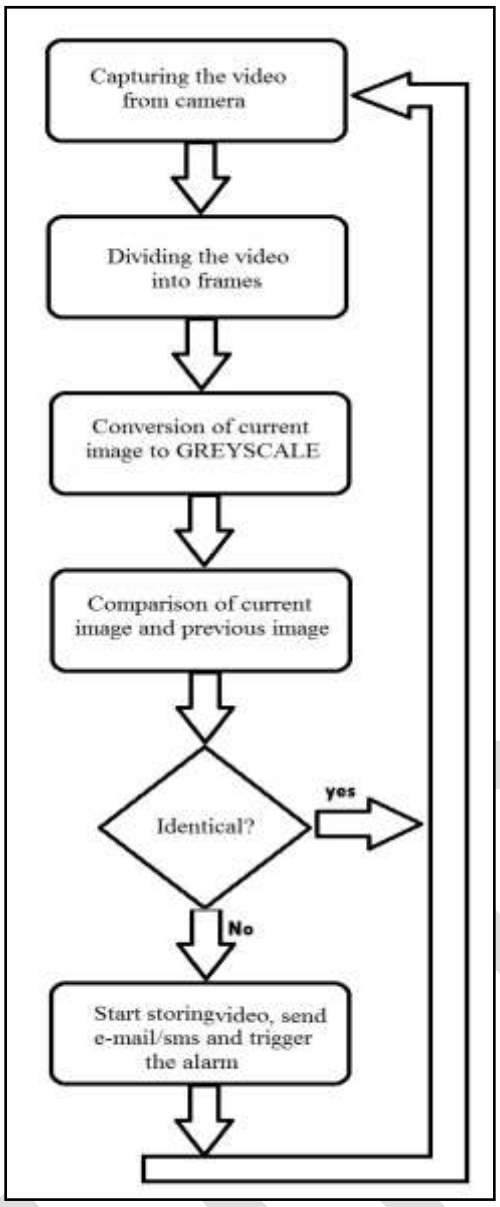

Fig.2 Flow of the proposed system

IV. DETAILS OF TECHNIQUES USED

A. Pre-Processing

Initially, the real-time video is divided into frames and pre-processing is used to improve the contrast of the image, removal of noise and for color conversion. The aim of pre-processing is improvement of the image as a data that suppresses unwanted distortions or enhances some image features important for further processing. There are four categories of pre-processing techniques namely, pixel brightness transformations, Geometric transformation, Local neighborhood of the processed pixel, Image restoration. We have used pixel brightness transformation for increased brightness without regard to position in the image.

B. SOBEL OPERATOR

- The SOBEL operator performs a 2-D spatial gradient measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges. Typically it is used to find the approximate absolute gradient magnitude at each point in an input grey-scale image.

This algorithm is based on absolute difference as well as region combination. Active regions are obtained by frame difference with an effective selected threshold value. Absolute difference is calculated by comparing the current frame captured with previous frame from the video sequence. This algorithm is efficient in moving object detection for video surveillance application.

The Sobel operator is slower to compute than the Roberts Cross operator, but its larger convolution kernel smooths the input image to a greater extent and so makes the operator less sensitive to noise. The operator also generally produces considerably higher output values for similar edges, compared with the Roberts Cross.

C. ALARM and SMS/E-mail

- This module is started using a thread which will enable the system to run this module simultaneously with video storage module.
- SMS and E-mail feature will be active iff the system is connected to the internet.
- The SMS/E-mail will be sent if the camera fails to give the input or the image received is completely black.
- Under such circumstances, alarm can also be triggered but completely depends on the user to enable the option.

D. Video Storage

This module is also started with the help of thread. It is enabled as soon as there is motion in the scene.

The video can be stored in AudioVideoInterface(.avi) or .wmv format so as to make it compatible with most of the video players.

The quality of the video is completely dependent on the camera used while the size of the video is dependent on both quality of camera as well as the time for which the motion is present in the scene.

V. RESULT AND ANALYSIS

The proposed system was tested in normal light as well as in medium dark light by using 4MP Camera. Detection works smoothly in both aforementioned scenarios.

Fig 3.1(a) Normal Frame

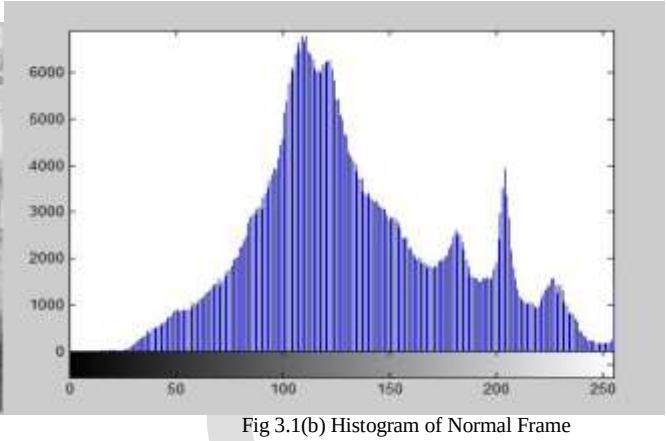

Fig 3.1(b) Histogram of Normal Frame

Fig 3.2(a) Frame with moving object

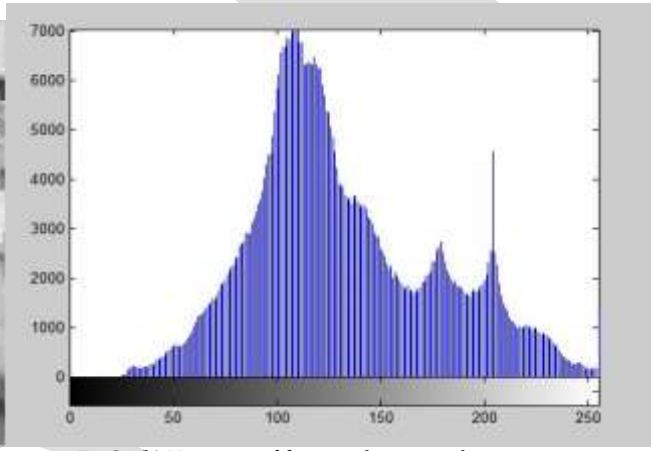

Fig 3.2(b) Histogram of frame with moving objects

Fig 4.1 is the normal frame where there is no movement and Fig 4.3 is the frame with movement. Fig 4.2 and 4.4 represents the histogram of normal frame and frame with movement respectively, which shows difference between two frames.

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CONCLUSION

Various existing motion detection algorithms like Sobel operator, Robert's cross, and Prewitt gradient edge detector available to video surveillance systems are studied. But while comparing the algorithms with each other we found that Sobel operator can be relatively easy to implement and results are decent. Roberts cross is quicker in computation but the results are far from the desired degree of accuracy and are mostly dependent on the noise present in the frame. We have an algorithm that analyze and classify video frames captured from surveillance camera help of some parameters like edge of object, gesture variations of object in that frame.

In our proposed scheme, therefore, Sobel operator motion detection algorithm with respect to the requirement of memory and time and the accuracy of result is selected for detecting the moving object without presence of shadow, particularly for banking applications and sensitive areas to improve the security.

Furthermore, include an option to take snaps periodically, manually or automatically to store the image with less number of bytes. We are implementing this system in real time and results so far, are positive.

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